Coroners Act, 1996
[Section 26(1)]

Western Australia

RECORD OF INVESTIGATION INTO DEATH

Ref No: 7/15

I, Evelyn Felicia Vicker, Deputy State Coroner, having investigated the death of ***Amanda Dana TAUAI****, with an Inquest held at Perth Coroners Court, CLC Building, 501 Hay Street, Perth on 24 and 25 February 2015 find the identity of the deceased was* ***Amanda Dana TAUAI*** *and that death occurred on 17 March 2012 at Royal Perth Hospital, Wellington Street, Perth as a result of multiple organ failure due to undefined sepsis (toxic shock syndrome) in the following circumstances -*

Counsel Appearing:

Ms I O'Brien assisting the Deputy State Coroner
Ms R Hill (State Solicitors Office) appeared on behalf of WA Country Health Service (WACHS) and Nurse Denise Smith and Nurse Veronica Bramley
Ms B Burke (ANF) appeared on behalf of Nurse Erin Maguire & Nurse Vicki Sherwell
Mr G Bourhill (Tottle Partners instructed by MDA National) appeared on behalf of Dr Mbaogu

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INTRODUCTION

Amanda Dana Tauai (the deceased) was a New Zealand national, working in Paraburdoo, when she became unwell and presented at Paraburdoo Hospital (the hospital) on 13 March 2012. She was admitted and treated for dehydration and gastroenteritis. She initially responded well to rehydration, but on the late evening of 14 March 2012 she began to deteriorate. In the early hours of 15 March 2012 the deceased's blood pressure dropped significantly, with an elevated heart rate.

Arrangements were made with the Royal Flying Doctor Service (RFDS) to transfer her to Port Hedland Regional Hospital (PHRH) but due to her presentation, and the presence of a cyclone, a decision was made to relocate her to Royal Perth Hospital (RPH). The deceased was treated with antibiotics by RFDS. These were continued by RPH on her admission at 1pm on 15 March 2012. It was suspected she was suffering from sepsis with cardiac, renal and liver impairment.

The deceased was transferred to ICU with suspected toxic shock on 16 March 2012 where, despite aggressive treatment, she died early on 17 March 2012.

The deceased was 21 years of age.

BACKGROUND

The Deceased

The deceased was born on 2 December 1990 in Tauranga, New Zealand. She was the oldest of three daughters born to Luma and Toa Tauai.

According to the deceased's mother she was a "sickly child" with frequent visits to the doctor's surgery and hospital. At four years of age the deceased had a serious bacterial infection and was hospitalised. She suffered severe eczema and asthma while growing up and Tauranga Hospital records indicate she had some presentations there suffering from viral infections and abdominal pains.[1]

In 2011 the deceased moved from Tauranga to Auckland to obtain some independence and found a job working for a power company. She became ill and returned home. A medical report from Auckland Hospital states she presented in December 2011 with abdominal pains but all investigations proved normal and she was discharged the following day. An ECG undertaken during the course of those investigations was normal and overall, despite her severe eczema, it would appear the deceased, by the time of

[1] Exhibit 1, Tab 8

her arrival in Western Australia, had no significant underlying medical conditions.[2]

The deceased was an active, social person and in 2005 had met Maurice Melligan (Mr Melligan). The two became, and remained, close friends and in July 2012 when the deceased wished to experience a change in life, with the prospect of earning more money, she moved to Paraburdoo in Western Australia where Mr Melligan was working.

On arriving in Paraburdoo the deceased lived with Mr Melligan and his father and reportedly settled into life in Paraburdoo very well, making a broad circle of friends and living more independently. She obtained two jobs to support herself while looking for further employment opportunities in the mining industry.[3]

The deceased worked at the local IGA as one of her jobs which brought her into contact with numerous people on a daily basis.

Paraburdoo Hospital

The hospital at Paraburdoo is small and staffed by five nurses who work to a roster. It comes under the auspices of the WA Country Health Service (WACHS) and the nearest co-hospital is at Tom Price, 80 kilometres away. The

[2] Exhibit 1, Tab 13
[3] T.24.2.15, p8

Regional Administration for these small hospitals comes under the control of the Regional Director for WACHS, in this case based in Port Hedland, over 500 kilometres away.

The hospital has two Emergency Department beds and two ward beds. Generally people are only admitted for minor illnesses which warrant discharge within 24 hours.

Small hospitals with few resources like that located at Paraburdoo frequently have no resident doctors.[4] Such small facilities have great difficulty attracting medical practitioners and it is not uncommon for there to be no medical practitioners available to the town. In an attempt to encourage doctors to practice in these remote areas WACHS supports a scheme whereby it assists general practitioners (GPs) in these remote regions in return for their assistance in the hospital. This involves the GP maintaining a private medical practice in rooms located within the hospital. The doctor sees private patients during normal business hours, but is available to the nurses from the hospital for emergencies. The GP has admission rights for patients being admitted to the hospital and is on call 24/7.[5] There are limited resources to deal with emergencies.

In March of 2012 Dr Mbaogu had been in Paraburdoo for four months. He was the first permanent doctor there for

[4] T.25.2.15, p116
[5] T.25.2.15, p114

three years, with the town relying on a locum service for those three years. Dr Mbaogu had 15 years experience as a GP, had worked in Australia, Canada and the UK and has a special interest in remote and rural health.[6]

Events Prior to Hospital Admission

On Saturday 10 March 2012 the deceased went out with friends in the evening and had a few drinks. Mr Melligan remained at home. The following day, Sunday 11 March 2012 the deceased and Mr Melligan went swimming at the Paraburdoo public pool following which they drove the 80 kilometres to Tom Price to collect groceries and had a meal before returning home.

On Monday 12 March 2012 Mr Melligan returned home from work to find the deceased ill in bed. She complained of 'flu' like symptoms. She was hot and sweaty, feverish and weak. The deceased was given some 'flu' tablets and remained in bed to see how she progressed.[7] By Tuesday 13 March 2012 the deceased appeared quite unwell and Mr Melligan booked her in to see Dr Mbaogu.

Dr Mbaogu saw the deceased at approximately noon on 13 March 2012 and she complained of a two day history of

[6] T.25.2.15, p113
[7] T.24.2.15, p9

fever, cold symptoms, dizzy spells, headache, abdominal cramps with vomiting but no diarrhoea or cough. On his examination of the deceased, Dr Mbaogu considered she had gastroenteritis and was dehydrated.[8]

Dr Mbaogu advised the Court this is a very common presentation in Paraburdoo due to the type of environment.[9] "Gastro" was a common problem in the town and he believed that with appropriate support the deceased would recover well. As a precaution, due to her high temperature and elevated heart rate, he directed she present, and be admitted, to the hospital.

ADMISSION TO PARABURDOO HOSPITAL

The deceased is recorded as attending at the triage window at the Emergency Department (ED) at the hospital at 12:20pm on 13 March 2012. She was triaged by Registered Nurse Denise Smith (RN Smith). RN Smith (now Clinical Nurse Smith) was working a morning shift, due to finish at 3pm that day. Generally, during the day there is only one nurse rostered on duty with a Patient Service Assistant. There are two nurses present between the hours of 1pm and 3pm as the afternoon nurse takes over from the morning nurse.

[8] Exhibit 1, Tab 11
[9] T.25.2.15, p119

The deceased presented with a referral from Dr Mbaogu requesting she be admitted to the hospital for treatment to be commenced as he outlined. He advised she had a history of vomiting, fever and dizziness and required resuscitation by way of rehydration and treatment for 'gastro'.

RN Smith triaged the deceased with a score of 3 (to be seen in 30 minutes) and took her through to the ED room to commence observations prior to medical review. The deceased was then provided with a secondary assessment by RN Smith and base line observations taken to be repeated every 15 minutes.[10]

An intra-venous (IV) cannula was inserted to enable IV fluids to be administered and bloods were taken from the deceased for analysis. The tests requested were a full blood picture (FBP), urea and electrolytes (PEU) and liver function test (LFT). These were collected at 12:50pm on 13 March 2012, but not received by the PathWest Laboratories until 1:06pm on 14 March 2012.[11]

At triage the deceased's temperature was 38.4^0 C, her heart rate 107bpm, her oxygen saturation 98%, her respiration rate 24 breaths per minute and her blood pressure 122/89. Following the commencement of IV fluids her observations showed her temperature fluctuating between 37.9 and 38.7^{0}C, her pulse rate dropped to 88, her blood pressure

[10] Exhibit 1, Tab 18
[11] Exhibit 1, Tab 18

remained normal, and her respirations decreased to 18. Her oxygen saturation remained good.

RN Smith treated the deceased in accordance with Dr Mbaogu's instructions pending his review. I have not been able to locate that referral on the file.[12]

Dr Mbaogu attended at an unspecified time to review the deceased and officially admit her into the hospital. His review is on the ED Triage Assessment form and documents the deceased's history as *"2/7 history of fever, cold symptoms, vomiting several times, dizzy spells, headaches, abdominal cramps without a cough or diarrhoea."* He recorded her previous medical history as being nothing significant with no allergies.

On his examination Dr Mbaogu recorded the deceased as *"ill looking, dehydration ++ temperature 40^{0}C, bp 98/62mmHg with a pulse of a 146bpm"*. He found her chest to be clear but she was tender in the lower abdominal area. He gives his impression as 1) dehydration and 2) gastroenteritis, with a plan to admit her and provide her with IV metoclorpramide, Buscopan, paracetamol, pantoprazole and rehydration by way of saline. The saline was to be initially fast running and then one litre over one hour.

[12] Exhibit 1, Tab 19, Para 18

The destination section of the assessment form indicates the deceased was to be admitted to a ward and that is dated as 13 March 2012 at 1pm.

The deceased's observations are recorded on the Emergency Department Secondary Assessment form from 1:15pm - 2:15pm signed by RN Smith, and from 3:30pm - 4:15pm signed by RN Sherwell. Her ward observations on the Adult Observation and Response Chart (AORC) commence at 6:15pm on 13 March 2012.[13]

It is common ground the blood collected by RN Smith at 12:50pm on 13 March 2012 was not dispatched on the 13 March 2012. The blood sample was collected the following day. Neither RN Smith or RN Sherwell can clarify where the blood taken at 12:50pm was stored,[14] however, for the purposes of FBP and the other tests ordered, storage at room temperature is not of concern.[15]

The PathWest result form for the blood collected on the 13 March 2012 only appears as one page of results in the medical file and was not readily available to Dr Mbaogu while the deceased was in his care. It had not even been received by PathWest at the times Dr Mbaogu reviewed the deceased. The file copy does not show the FBP and has only recorded PEU and LFT results. These indicate the

[13] Exhibit 1, Tab 18
[14] T.24.2.15, p58, 79
[15] Exhibit 4 and 5

deceased's potassium was low and creatinine was high, but these results were not available to assist Dr Mboagu.[16]

From 1pm until 3pm on 13 March 2012 both RNs Smith and Sherwell were on duty until RN Smith went off shift at 3pm. RN Sherwell's progress note at the conclusion of her shift indicates the deceased remained febrile, alert and orientated and that IV hydration was still running. The AORC entries for RN Sherwell's shift reflect her entry in the progress notes.

By 5:50pm the deceased was in a ward bed and reviewed by Dr Mbaogu. The deceased reported to Dr Mbaogu she was feeling better with no nausea, vomiting, abdominal cramps or diarrhoea. She was still dizzy, with an elevated temperature but was making urine.

On Dr Mbaogu's examination the deceased had a temperature of 39^0C, her blood pressure was 121/64 and her pulse 101bpm. Her abdomen was flat and soft with mild generalised tenderness, without guarding. Dr Mbaogu assessed the deceased as suffering from a fever, dizziness and gastroenteritis and his plan was to continue the current treatment but to alternate saline with dextrose. His prior instruction, she have nothing by way of oral intake, was replaced by a plan she could have oral fluids as she could tolerate them.

[16] T.25.2.15, p133

The night shift of the 13-14 March 2012 was rostered to RN Erin Maguire. Like RN Smith, RN Maguire was also from New Zealand. Both nurses felt they had a good rapport with the deceased having a homeland in common. RN Maguire found her ability to chat with the deceased about her homeland provided her with lots of opportunity to assess the deceased's well-being.[17]

Throughout the night RN Maguire recorded the deceased stated she felt a bit better, but remained febrile with a fast heart rate. The deceased did not seek extra attention, although RN Maguire heard her going to the toilet on occasion, and the deceased self-reported she had vomiting and diarrhoea, but without abdominal pain. RN Maguire continued the rehydration and medications as charted.[18]

14 March 2012

RN Maguire noted the deceased's IV lines would kink whenever she bent her arm which caused a lapse in rehydration. Thereafter, the deceased was observed to be sleeping soundly until she vomited at approximately 4:40am on 14 March 2012, again without seeking assistance. When asked, the deceased informed RN Maguire she felt nauseous and had some mild abdominal cramping when she vomited,

[17] Exhibit 2
[18] Exhibit 1, Tab 18

however, it was noted she appeared to be more hydrated and her lips were moist.

The deceased still had an elevated temperature and a fast heart rate although it had declined slightly. She was provided with ondansetron for vomiting, and Panadol to reduce her fever, with IV Hyoscine butylbromide in IVF saline to assist with the abdominal cramping. Thereafter the deceased continued to rest and was heard to visit the toilet where she self-reported a large bowel motion. She had also passed urine which was an indication rehydration was effective and her kidneys were functioning.

At 6:30am RN Maguire repeated the deceased's observations. Her temperature had fallen to within the normal range and her heart rate was only slightly elevated at 104bpm. Her respiratory rate was within normal limits. Her IV hydration continued and appeared to be effective.

Just before RN Maguire went off shift at 7am she telephoned Dr Mbaogu to report on the deceased's progress. She explained the deceased had continued with an elevated temperature which had now improved, and had nausea and diarrhoea overnight, which also appeared to have improved. She noted the deceased had yellow sclera. In her progress note she described the deceased as comfortable, with yellow sclera, and that she had discussed that with Dr Mbaogu who was not concerned about jaundice.

The morning shift on 14 March 2012 was again rostered to RN Smith. On RN Smith's commencement at 7am the deceased's vital signs were essentially within the normal range, although the AORC temperatures are incorrectly entered.

Dr Mbaogu reviewed the deceased prior to his morning clinic at 8:15am. In his entry in the progress notes he recorded the deceased as having vomited twice during the night and that she felt nauseous and light headed. The deceased denied any abdominal pain or diarrhoea, and no longer had a temperature, although she was feeling lethargic.

Dr Mbaogu examined the deceased's eyes in view of the comments with respect to dirty sclera, but had been told previously by the deceased that her sclera were usually that colour.

Dr Mbaogu noted tenderness in the deceased's lower abdomen with no enlargement of either her lymph nodes or organs on palpitation. He clarified some of the deceased's abdominal signs with her and she stated she was mid-menstrual cycle and was not sexually active. He assessed her as slightly improved, and planned the deceased be continued on her current treatment plan.

The deceased's presentation on Dr Mbaogu's review at 8:15am on the 14 March 2012 recorded observations within the normal range, including her temperature which had dropped overnight to the normal level.

Dr Mbaogu requested repeat blood tests, including FBP, PEU and LFT, with the addition of specific investigations for viral infections such as hepatitis A and B and Ross River Virus and urine and stool analysis.

RN Smith took the ordered bloods and samples and took them to the PathWest Collection Point along with those collected the previous day.[19] RN Smith continued to monitor the deceased and provide her with antiemetics and fluids in accordance with her charts.

Dr Mbaogu next reviewed the deceased before 12:30pm. Although his entry in the Progress Notes is untimed he ordered the deceased be given ondansetron, which RN Smith charted at 12:30pm, following her observations recorded for the deceased at 12:15pm. Those observations are largely in the normal range with a respiratory rate (22) and heart rate (104), slightly elevated. No temperature was recorded but the oxygen saturations remained good.

Dr Mbaogu noted the deceased had not vomited or reported diarrhoea, although she was still lethargic and feeling

[19] T.24.2.15, p60

nauseous. She had dry lips and he again queried whether her sclera were really usually that colour or she may be showing signs of jaundice, which would indicate liver compromise.[20] He asked the deceased's treatment and management remain as charted with the antiemetics provided. He believed the deceased would be well enough to be discharged the following day, once he had an opportunity to review the deceased's blood results.[21]

RN Smith's note for the shift indicated the deceased's management continued as charted and that following the provision of odonsetron the deceased reported an improvement in her nausea. RN Smith noted the deceased was able to shower independently and was visited by friends.

Mr Melligan advised the Court that when he visited the deceased on the afternoon of 14 March 2012 she seemed to be improving. He recalled her as being more vibrant and responsive and he believed she was getting better.[22]

The afternoon shift on the 14 March 2012 was rostered to RN Veronica Bramley. This was her first contact with the deceased. Due to the overlap of shifts between 1 and 3pm it is not clear who took the 3pm observations, both nurses in

[20] T.25.2.15, p132
[21] T.25.2.15, p150
[22] T.24.2.15, p,10

their statements seemed to believe they had taken them.[23] RN Bramley certainly took those at 6pm as recorded on the AORC and made entries to the deceased's Progress Notes at 3:30pm, 8:10pm and 8:40pm. In her assessment the deceased was comfortable and stable and this was reflected in the content of the notes and charts.

The AORC reflects a spike in the deceased's temperature at 3pm, to 39.8^{0}C, but thereafter a return to normal. Neither nurse comments on that spike in their entry in the progress notes. According to the AORC, a temperature spike of 39°C warranted increased monitoring and medical review within 30 minutes.

During her shift RN Bramley noted the deceased's observations to be within normal limits. She considered the deceased was pale, weak and lethargic, but alert and orientated with the deceased telling RN Bramley she felt better to the extent she was able to eat and drink a little.

Approximately 2 hours after eating the deceased again vomited undigested food, but stated she felt better once she had vomited, and continued to sip flat lemonade for the rest of RN Bramley's shift. RN Bramley managed the deceased in accordance with Dr Mbaogu's charted plan and handed over to RN Maguire at approximately 9pm.[24]

[23] Exhibit 1, Tab 19, Exhibit 6
[24] Exhibit 6

NIGHT SHIFT 14-15 MARCH 2012

Overnight from the 14-15 March 2012 RN Maguire had two patients in the hospital for whom she was responsible. She was advised on hand-over the deceased was comfortable, had eaten a small dinner which she vomited, and was feeling nauseous and lethargic. She took her first set of observations at 10pm and noted the deceased as remaining pale with dry lips. The deceased's blood pressure at 10pm on the AORC is 93/61 mmHg. According to the AORC that warrants increased observations to every 15 minutes and medical review in 30 minutes. In evidence Dr Mbaogu stated he would have expected to have been informed about the deceased's declining BP at 10pm on 14 March 2012.[25].

The deceased self-reported feeling much better, although she still had loose bowels and slight nausea.

RN Maguire spent some time chatting with the deceased and noted there continued to be a problem with IV fluid flow due to kinking of the tubing to the deceased's arm. She re-sited the IV cannula to improve the flow of fluids and assist continued hydration.

The deceased advised RN Maguire she wished to sleep and she was provided with a bell should she need the nurse during the night. RN Maguire's progress notes state the

[25] T.25.2.15, p153

deceased was not showing signs of low blood pressure, although it was lower than it had been, and that overall she was stable and her temperature in the normal limits. She was still pale with yellow sclera. Due to the deceased continuing to dry retch RN Maguire provided her with more antiemetic medication and paracetamol at 11pm as charted.

The major recorded signs of the deceased's decline appear to occur after 2am on the 15 March 2012. There is no indication any observations were taken between 10pm on the 14 March 2012 and 2:20am on 15 March 2012 although RN Maguire apparently became concerned about the deceased before those observations were taken.

The progress notes indicate RN Maguire spoke to the deceased about her dry retching.

RN Maguire's documentation in the progress notes is very comprehensive, but not consistent with the times charted on the various fluid, medication and AORC. I have taken the view the timing on the various charts in the deceased's medical file are, of both necessity and practicality, more reliable than those in the margins of the progress notes.

The charts are more consistent with Dr Mbaogu's recollection of the chronology of events as outlined in the progress notes. Consequently, I accept that when RN Maguire rang Dr Mbaogu at around 2:05am with concerns

for the deceased, Dr Mbaogu responded with instructions he hoped would improve her condition by way of antiemetic medication. Dr Mbaogu asked RN Maguire to ring him back after she had provided the deceased with additional Stemetil and hydration.[26] When that did not occur he rang back.

I accept RN Maguire would have been very busy by then treating the deceased who was distressed and attempting to pull out her cannula.

Dr Mbaogu's evidence was that when he called RN Maguire back she said the deceased was increasingly unwell and he asked her to take the deceased's vital signs and call him back. It may be Dr Mbaogu declined to come in until the vital signs had been taken because, according to the AORC, none had been taken since 10:00pm the previous night. Dr Mbaogu does not recall ever declining to attend the hospital.[27] The progress notes state Dr Mbaogu *"will not come in at this stage"* with a timing of before 2:15am on 15 March 2012.

The observations taken at 2:20am recorded a significantly low blood pressure which must have been communicated to Dr Mbaogu after those observations were taken and he was called back.[28] This would be more in accordance with a telephone call after 2:20am and is more in line with

[26] T.25.2.15, p132
[27] T.25.2.15, p136, 139
[28] T.25.2.15, p135

Dr Mbaogu's evidence he attended hospital once advised of the abnormal observations.

The deceased was extremely unwell by that time. Thereafter the deceased vital signs are recorded appropriately at 5 to 10 minute intervals, with Dr Mbaogu arriving at some time prior to 3am, while RN Maguire was attempting to re-insert the cannulas pulled out by the deceased. Dr Mbaogu, in evidence, described how difficult it was to re-insert a cannula with the deceased's blood pressure so depressed.[29]

The deceased was alert and orientated but clearly unwell. Once re-insertion of the cannula was achieved, at a much smaller diameter than considered optimal,[30] her hydration continued.

She needed constant input for her resuscitation. RN Bramley was the first on-call nurse and she received a telephone call from RN Maguire at approximately 3:30am 15 March 2012 asking for assistance.

RN Bramley recalled RN Maguire as being very flustered and frustrated because she wanted to provide the deceased with Gelofusine but Dr Mbaogu insisted on IV saline.[31] RN Bramley said she arrived at the hospital shortly after the telephone call, and that she assisted with inserting the

[29] T.25.2.15, 140
[30] T.25.2.15, p141
[31] T.25.2.15, p86, Exhibit 6

indwelling catheter (IDC) and setting up a dopamine infusion.

RN Bramley described the deceased as still responsive and alert, but with a clear deterioration in her presentation from when she had last seen her six hours earlier. RN Bramley considered the deceased had been reasonable when she rostered off at 9:20pm on the 14 March 2012, but was obviously unwell by the time she reached the hospital sometime around 3:30am on the 15 March 2012.[32]

Dr Mbaogu was already making arrangements to have the deceased transferred by the RFDS to the PHRH for intensive care.

Dr Mbaogu's evidence was that when he arrived at the hospital on the morning of 15 March 2012 his concern was the deceased's blood pressure which, in the context of the other observations, indicated the deceased had profound hypotension. This reflected the development of a shocked system. Dr Mbaogu still believed the deceased was suffering gastroenteritis, but was concerned she was suffering profound hypotension. He did not consider the deceased's temperature to reflect a bacterial infection, although her heart rate and respiratory rate were mildly elevated.

[32] T.24.2.15, p88

Dr Mbaogu was concerned the deceased was suffering hypovolemic shock as a result of fluid loss due to her vomiting. He believed that was the reason for her low blood pressure and for her veins to have collapsed. Dr Mbaogu's focus was to resuscitate the deceased with fluids because he believed she was dehydrated. In evidence, he stated he did consider a bacterial infection, as opposed to a viral infection, but did not believe her clinical signs were consistent with a bacterial infection. It was not his clinical judgement that her stable temperature for the previous 10 hours warranted the provision of antibiotics.[33]

Dr Mbaogu explained he does not believe in administering antibiotic medication unless there is a clear necessity. He was concerned the over administration of antibiotics is responsible for causing resistant strains of bacteria and can cause other complications for a patient.[34]

In addition, Dr Mbaogu said he also considered the benefits of taking bloods for culture at that time, however, the deceased's hypovolemia was so extreme they were having difficulty with the insertion of the cannula. With the successful insertion of an appropriately sized cannula the back flush of blood can be used. It was only possible to insert a 22 cannula which is very small. In Dr Mbaogu's view it was not practical to aspirate blood for the purposes of culturing at 3am on the 15 March 2012. His priority was

[33] T.25.2.15, p140
[34] Clostridium difficile

supporting her blood pressure by way of rehydration and dopamine. He did not want to compromise the deceased's blood pressure any further by aspirating blood for cultures. He was clear she needed resuscitation in preparation for transfer to a larger facility with appropriate life support facilities. This was not available in Paraburdoo.

Despite Dr Mbaogu's prior concern of a possible inflammation in the pelvic area, there was no evidence to support the deceased may have a focus for bacterial infection.

Dr Mbaogu was still focused on the fact he did not believe the deceased's symptoms to be consistent with a bacterial infection and therefore did not believe antibiotics to be a priority.[35] In Dr Mbaogu's view the deceased was exhibiting a shocked response and the clinical feature of most concern was her low blood pressure. The deceased was lucid and alert, and he believed her blood pressure would improve if he could support her successfully. She was not feverish, had a normal temperature and his concern was with her vomiting and marginally elevated pulse and heart rate.

Dr Mbaogu agreed he would probably have a lower threshold to the administering of broad spectrum antibiotics, in hindsight, but at that time he required a very

[35] T.25.2.15, p143

high indication of a bacterial infection before he would administer antibiotics.[36]

The deceased had undergone an ECG in Paraburdoo on both the 13 March and the morning of the 15 March 2012. 15 March 2012 ECG showed signs of tachycardia with ST elevation in the anterolateral leads which had not been present on 13 March 2012. This suggested an inflammatory process involving the heart.[37]

Dr Mbaogu contacted PHRH Emergency Department and discussed the deceased with the on call consultant there. It was decided she should be transferred as soon as possible because they had appropriate facilities to support her system. Arrangements were made for the RFDS to attend. RN Bramley returned home as there was nothing further she could do to assist Dr Mbaogu and RN Maguire.

While waiting for the transfer the deceased's dopamine infusion was increased and her blood pressure responded by elevating slightly, but was still of concern.[38] The deceased was still unable to successfully take fluids orally without vomiting.

RN Maguire attempted to contact Mr Melligan to advise him they would be transferring the deceased by RFDS to Port

[36] T.25.2.15, p144
[37] T.24.2.15, p32
[38] Exhibit 1, Tab 18 Adult Observation and Response Chart

Hedland. By 6:30am Mr Melligan had arrived and the deceased was being given IV ondansetron and the dopamine infusion continued. The deceased denied pain and was able to tolerate small sips of water.

The RFDS arrived and the deceased was transferred to the airport at approximately 8:30am with RN Smith in attendance for the transfer. Mr Melligan also travelled in the ambulance and overheard RN Smith discussing the doctor's management of the deceased with the ambulance officers. This appeared to be based on the progress notes, not the evidence as reflected in the deceased's charts.

On the medical discharge summary Dr Mbaogu outlined the deceased's problems as vomiting/nausea, lethargy, abdominal cramps, jaundice, and hypotension. She was managed by transfer to the airport with a dopamine infusion and 0.9% saline at 500mls per hour. There is a notation that instead of being transferred to Port Hedland, the flight was re-directed to RPH.

Dr Mbaogu's letter to the Emergency Physician in Port Hedland outlined her presentation and his treatment and the fact she was noted to have a blood pressure of 63/33mmHg at 2:20am with a heart rate of 115bpm. Her fluids were increased with a litre bolus, followed by one litre over 30 minutes, then 500mls in 30 minutes with no effect and her blood pressure remained low. A dopamine infusion

was commenced and on transfer there was a marked improvement in her blood pressure to 116/46mmHg whilst supine, with a pulse rate of 95bpm. He outlines her problems as hypotension (on dopamine infusion), jaundice and retching.

At the time of the deceased's transfer there was a cyclone approaching and a decision was made to change the destination from PHRH to RPH.

AVAILABILITY OF BLOOD RESULTS TO ASSIST IN PARABURDOO

Due to the remoteness of Paraburdoo Hospital diagnostic tools such as blood test results are delayed. Blood was taken from the deceased for a full blood picture (FBP), urea and electrolytes (PEU), and liver function tests (LFT) on both 13 & 14 March 2012. Additional tests were also requested on 14 March 2012 but those results were not available until considerably later in the week.[39]

There was nothing to indicate at the time bloods were taken the deceased was going to deteriorate, so none of the requests to the pathology lab were marked as urgent.[40] It does not appear that would have significantly altered the timing of the results due to the need for transport by plane. Additionally, due to the need for samples to be stored for a

[39] T.25.2.15, p159
[40] T.25.2.15, p119, 129

period of time before analysis, the medium (EDTA) in which the blood is stored affects the results for useful blood film morphology.[41] This prevents assessment of the development of some types of cell.

The bloods taken on 13 March 2012 were not taken in time for collection on that date and those bloods were sent to the laboratory at the same time as those collected on 14 March 2012. Both sets of bloods were received by the laboratory at just after 1pm on 14 March 2012. The results of the various tests became available at different times.

The only results which became available in Paraburdoo while the deceased was there were the biochemistry (PEU & LFT) results for 13 & 14 March 2012. Those were posted on the PathWest server at 11:15pm on 14 March 2012, and the PathWest printer at the hospital at 6:37am on 15 March 2012. Those results supported her management. The FBP for 14 March 2012 came through at 00:46am on 15 March 2012, because the blood had clotted and could not be analysed. The FBP for 13 March was not available online in the hospital until 11:06am on 15 March 2012 by which time the deceased was with the RFDS.[42] These results showed a mild elevation in the deceased's neutrophils which may support a bacterial infection.

[41] Information provided by PathWest on 17 March 2015 and provided to the parties
[42] Additional information provided by PathWest on 17 March 2015 and provided to all the parties.

Blood cultures were not ordered, but would not have become available before the deceased's deterioration.[43]

RFDS TRANSFER

The deceased's observations with the RFDS commenced at 9:20am 15 March 2012 and the flight doctor, Dr Ron Dobson, diagnosed the deceased as suffering from septic shock. The deceased was noted as being mildly jaundiced, but her chest was clear and her urine output, concentrated. She was provided with noradrenaline. There was no focal evidence of infection, but the deceased was administered broad spectrum antibiotics (ceftriaxone) at 9:45am.

While on board the flight the deceased's noradrenaline infusion was increased, but she remained hypotensive with her systolic blood pressure varying between 65 and 89mmHg, with a persistent tachycardia varying between 116 and 132bpm. She was alert and orientated with mild abdominal pain.[44]

The flight left Paraburdoo at 9:25am and the deceased arrived at RPH at 1pm on the 15 March 2012.

ROYAL PERTH HOSPITAL

An ECG taken on the deceased's arrival revealed a "pericarditis picture" although her chest was clear, her

[43] T.25.2.15, p130
[44] Exhibit 1, Tab 17, RFDS

oxygen saturation 99% and her blood pressure 110/70 on single strength noradrenaline 15ml hour. The deceased still had a temperature in the normal range, but her abdomen was generally tender. The pelvic examination revealed a foul smelling yellow discharge and culture subsequently revealed a moderate growth of *Candida albicans*. The deceased had cervical excitation with right adnexal tenderness, although blood cultures still showed no bacterial growth, probably as the result of the continued administration of antibiotics.[45]

The working diagnosis for the deceased was septic shock with cardiac, renal and liver involvement, with heart changes on ECG and an elevated troponin. An echocardiogram showed normal contractile function and normal left ventricular dimensions and function and no valvular disease. Arterial blood gas analysis indicated a marked metabolic acidosis with elevated lactate and wide anion gap.

The deceased was transferred to the Intensive Care Unit where she developed a rash and thrombocytopenia. A skin biopsy the following day revealed leukocytoclastic vasculitis.[46]

The deceased was diagnosed as suffering septic shock with multi organ failure and was treated with high doses of

[45] Exhibit 1, Tab 13
[46] Exhibit 1, Tab 17

inotropes, vasopressors, venovenous haemodiafiltration, Intragam and broad spectrum antibiotics.

Mr Melligan travelled from Paraburdoo to RPH to be with the deceased.

The deceased suffered a cardiac arrest on the early morning of 17 March 2012 and could not be resuscitated. She died shortly before Mr Melligan was able to reach her.

POST MORTEM REPORT

The post mortem examination of the deceased occurred on the 20 March 2012 and was undertaken by the Chief Forensic Pathologist, Dr Clive Cooke. Following all investigations Dr Cooke formed the opinion the deceased had died as a result of multiple organ failure due to undefined sepsis (toxic shock syndrome).

Dr Cooke was not able to locate a specific site of infection during the post mortem examination. He confirmed shortly prior to the inquest there was no evidence of abscesses or any other focal point for infection during the course of the post mortem examination.[47]

Viral testing was negative and while microbiology showed some candida, as well as bacteria, none were focal and no

[47] Exhibit 4

specific infection was identified, although it was accepted the deceased had been treated with antibiotics. Fungal infection was negative and neuropathology only showed non-specific congestion. Toxicology confirmed her medical treatment.

Dr Cooke agreed the medical features at post mortem were consistent with the clinical diagnosis of toxic shock syndrome, however, he was unable to locate any evidence of where an infection had been located.[48]

EXPERT OVERVIEW

Dr Michael McComish, Consultant Physician, was asked by the court to review the medical management of the deceased.

Dr McComish reviewed the documentation provided to him which consisted of the deceased's medical record. Dr McComish was in a position to review the record with the results of all the blood tests authorised by Dr Mbaogu.

Dr McComish was satisfied the deceased had no significant underlying medical conditions at the time she presented to Paraburdoo Hospital on the 13 March 2012.

[48] Exhibit 1, Tab 14

With the benefit of the complete blood results taken on 13 March 2012 and 14 March 2012 Dr McComish could confirm the deceased had hypokalaemia (low potassium), with low bicarbonate suggestive of acidosis, and creatinine of a level suggestive of mild renal impairment. The liver function tests indicated a mildly elevated bilirubin.

Dr McComish pointed out the delay in a doctor being able to access information from a FBP was of concern because the abnormalities one would expect to have observed in view of the post mortem findings, may have given Dr Mbaogu a clue that antibiotics were warranted at an earlier stage. This had the potential to have altered the outcome of this case.

Dr McComish explained the results of a FBP may have assisted with a diagnosis of bacterial, as opposed to viral, gastroenteritis, had there been an elevation of neutrophils in the blood. The results of 13 March 2012 FBP, not available until 11:06am 15 March 2012, did indicate a mild elevation in the neutrophil count.

Dr Mbaogu agreed that had he had access to the blood test results he ordered on 13 and 14 March 2012 he would have been in a better position to manage the deceased and may have considered her gastroenteritis to be bacterial in origin.[49]

[49] T.25.2.15, p133

Dr McComish concluded the management of the deceased up until her decline in the early hours of the 15 March 2012 was reasonable.[50]

Dr McComish commented, "*The diagnosis of (presumably viral) gastroenteritis and dehydration were not unreasonable"*, but goes on to say "*the persistence of high fever, tachycardia, nausea and vomiting and the development of hypotension in the early hours of the 15 March 2012 suggested a more serious condition like septic shock*".

However, the reality was Dr Mbaogu did not have access to a FBP and, therefore, did not have the benefit of the neutrophil count for the deceased which may have assisted him with the diagnosis of a bacterial infection, as opposed to a viral infection, and so encouraged the use of antibiotics. Additionally the AORC for the deceased, if properly filled out did not show persistent high fever, nor significant tachycardia until the early hours of 15 March 2012.[51]

It is at that point Dr McComish believes empirical antibiotics should have been administered which may have changed the outcome for the deceased.[52]

[50] T.24.2.15, p20
[51] T.24.2.15, p26
[52] T.24.2.15, p30

Dr McComish went on to explain he has a low threshold for the administering of antibiotics and he may well have administered antibiotics to the deceased before the morning of the 15 March 2012. He agreed many medical practitioners are of the common view antibiotics should not be administered without a clear indication they are necessary.[53]

Dr Philip Montgomery, regional Medical Director WACHS Pilbara, provided information to the court[54] in which he stated "*In this case the working diagnosis was gastroenteritis for which antibiotics would not usually be prescribed whether it was viral or bacterial*". He clarified the use of broad spectrum antibiotics is a matter of clinical judgement and that the indiscriminate use of antibiotics is contrary to the principles of antimicrobial stewardship and the Australian Therapeutic Guidelines.

It is the issue of 'clinical judgement', which remains an informed value judgement, and is a major tension without timely diagnostic tools. It is the indiscriminate use of antibiotics which has produced resistant strains.

Dr McComish believed the clinical signs were the deceased had a pelvic inflammation, based on Dr Mbaogu's examination of her. He confirmed the questions asked by Dr Mbaogu were appropriately asked and an attempt to

[53] T.24.2.15, p40, 41
[54] Letter 13 March 2015 provided to all parties

establish the existence of pelvic inflammation which may have been bacterial in origin. Without FBP to provide valuable information, Dr Mbaogu's basis to diagnose a bacterial infection was restricted.

The results for the biochemistry tests of 13 March indicated hypokalaemia (low potassium), acidosis and mild renal impairment, all of which were consistent with dehydration and a presentation of vomiting with diarrhoea.[55] Those for 14 March reflected continued low potassium but improved bicarbonate and renal function, with jaundice. Those results reflect a good response to the treatment provided to the deceased and suggest *"the rehydration has been successful in reversing the mild impairment of renal function and partially correcting the potassium loss....the intervention was, in that regard, successful".*[56] They indicated the rehydration was appropriate and there was no other information in the results which could have assisted at that point. It was the FBP which may have pointed to a cause for the later crash which was not available.[57]

Dr McComish was also of the view blood cultures should have been taken at the earliest opportunity in the hope they would also provide a guide.[58] Again Dr McComish believed one would receive the results within 12 to 24 hours. While they would not have assisted Dr Mbaogu because PathWest

[55] T.24.2.15, p20
[56] T.24.2.15, p25
[57] T.24.2.15, p28
[58] T.24.2.15, p40

did not receive bloods until just after 1pm on 14 March 2012, Dr McComish believed it could have provided information to a later practitioner managing the deceased. By the time blood cultures were prepared at RPH, antibiotics had already been administered and there was no significant evidence of a specific bacteria on culture.

Dr McComish believed, had the deceased been given broad spectrum antibiotics at 3am on the 15 March 2012, the outcome for the deceased may have been improved, however, could not state with certainty it would have changed her prognosis. He confirmed not all practitioners would have opted for antibiotics at that time but believed it would have been an appropriate option, provided blood was taken for culture before the administration of antibiotics.

Dr Mbaogu agreed he now has a lower threshold for the administering of antibiotics in a similar situation, but was still of the view the deceased's presentation, with a stable temperature for the 10 hours preceding the significant lowering of her blood pressure, was still a factor which did not indicate a bacterial infection. Dr Mbaogu stated he would have preferred to have been notified at 10pm the previous evening of the deceased's declining blood pressure. Increased monitoring may have shown a decline. This would have given him more opportunity to manage the deceased before there was a crisis.

CONLCUSION AS TO THE DEATH OF THE DECEASED

I am satisfied the deceased was a 21 year old resident of Paraburdoo, a remote mining town, in March 2012. She had been relatively fit and healthy during her time in Paraburdoo and, preceding her beginning to feel unwell on 11 March 2012, had been participating in community sporting events.

She felt unwell on the 11 March 2012 and on the 13 March 2012 was so unwell her friend, Mr Melligan, took her to the hospital where she was seen by Dr Mbaogu who referred her to the hospital for admission.

Dr Mbaogu diagnosed dehydration and gastroenteritis. This was not an uncommon presentation in Paraburdoo at that time, and the deceased's signs and symptoms were consistent with that diagnosis.

On her admission into hospital resuscitation was commenced to re-hydrate her and treat her nausea. The deceased initially responded well to treatment and by the afternoon of the 14 March 2012 appeared to be improving. Dr Mbaogu last reviewed her at approximately 12:15pm on 14 March 2012 at which time her observations were relatively normal. He was confident his plan for her management was appropriate and she seemed to be

responding. When visited by her friend, Mr Melligan, he confirmed she appeared to be improving.

Thereafter, the deceased remained relatively stable from the clinical perspective, however, the nurses were concerned at her continued lethargy. The deceased experienced a spike in her temperature at approximately 3pm on the 14 March 2012, but her other observations remained stable and her temperature returned to the normal range by 6pm and remained there for the rest of her time in the hospital. Dr Mbaogu was not contacted at 3pm. Nor was he advised of her deteriorating blood pressure at 10pm that night. Dr Mbaogu was contacted at about 2:05am on 15 March 2012 due to the deceased's continued vomiting.[59]

Observations for the deceased do not appear on the AORC until 2:20am on the 15 March 2012, apparently after Dr Mbaogu requested they be taken and he be advised of the results, due to the deceased's deterioration. Once alerted to the recorded observations Dr Mbaogu gave instructions for the deceased's deteriorating blood pressure to be addressed, and arrived at the hospital at a time RN Maguire was having difficulty with the deceased's infusion due to her removing of the cannula.

From that point both Dr Mbaogu and RN Maguire were concerned with active resuscitation of the deceased in an

[59] T.25.2.15, p135

attempt to stablise her blood pressure. RN Bramley was called to assist and the deceased was stabilised. Arrangements were made for her emergency transfer to PHRH. She was not treated with broad spectrum antibiotics because there was no clear diagnosis of a bacterial basis for her infection.

The deceased was to be transferred to PHRH, however, the presence of a cyclone and her presentation made re-direction to RPH necessary. She was diagnosed with septic shock, following blood gas analysis and an ECG in flight, and provided with broad spectrum antibiotics prior to her arrival at RPH.

On arrival at RPH the deceased was diagnosed with septic shock and resuscitated appropriately, however, she developed multi-organ failure and in the early hours of the 17 March 2012 arrested, and could not be revived.

Post mortem examination confirmed the clinical diagnosis of multi-organ failure, although the site for any infection causing septic shock could not be identified.

Dr McComish believed, on all the clinical evidence including the FBP for 13 March 2012, it was likely the deceased had a bacterial pelvic infection which had caused septic shock.

I find the deceased died by way of Natural Causes.

COMMENTS ON THE ADMINISTRATION OF PUBLIC HEALTH IN REMOTE AREAS

The difficulties in providing adequate health cover in remote areas due to the facilities and resources available to health practitioners is one of the reasons doctors are in short supply in remote areas. Doctoring in remote areas is extremely demanding because the types of supports considered essential are not available in the time frequently required for emergency situations. Most remote areas do not have ICU facilities and when patients deteriorate rapidly, not uncommon in young patients, the type of support needed to keep their life systems viable is not readily available. Resuscitation in remote areas is extremely hard.

The situation is exacerbated when diagnostic tools useful in diagnosis and management are delayed, and in the case of the deceased not available at all. Dr McComish agreed the most important thing for the deceased on her presentation was re-hydration. Dr Mbaogu's management plan for her re-hydration was appropriate. The deceased initially responded to that management and appeared to be improving. This supported Dr Mbaogu's diagnosis.

I accept Dr McComish referred to the deceased's *"ongoing high temperature"* but note the AORC does not support on-going high temperature after the spike on the 14 March

2012 at 3pm, unknown to Dr Mbaogu. Post admission from 6:30am on 14 March 2012, prior to that spike, and following that spike, the deceased's temperature remained in the normal range between 36 and 37^{0}C. Dr Mbaogu had last reviewed the deceased at approximately 12:30pm on 14 March 2012. At that time the deceased's clinical signs were all in the acceptable range.

Both Dr McComish and Dr Mbaogu, in evidence, covered the benefit to Dr Mbaogu of having access to a FBP in real time. I emphasise these had been ordered, but were never received, by Dr Mbaogu while the deceased was in his care.

Viral infections often cause a fall in a particular white blood cell, neutrophils. They often produce thrombocytopenia and a lymphocytosis.

Generally, bacterial infections cause a rise in neutrophils, but more importantly, as of 13 March 2012, it is possible a FBP could have shown precursor white blood cells[60] in the deceased's system as well as the slightly elevated neutrophil count. This could have alerted a clinician to the potential for the deceased's system to be producing extra neutrophils. The information on cell morphology is never available to remote clinicians due to the storage medium for the blood tests destroying that information. Consequently, clinicians

[60] T.24.2.15, p42

in remote areas have to rely on estimates of an increase in neutrophils in conjunction with other clinical signs.

A comparison between the FBP on the 13 March 2012 and the 14 March 2012 may have shown an elevating neutrophil count which could provide a clinician some guide to the fact he needed to be considering a bacterial infection, despite the deceased's apparently stabilising temperature. However, that also was not available in this case due to the clotting of the sample for 14 March 2012 and the delay in receipt of any results.

I appreciate WACHS has gone to some lengths to improve resourcing in these remote areas and that has initially been done by the provision of medical practitioners, via various enticements, not available previously. A number of these remote areas had little or incomplete medical practitioner coverage and nurses were responsible for medical care.

Locations like Paraburdoo still need resourcing with appropriate support and facilities if they are to attract medical support. The difficulties of a doctor being on-call 24/7 are enormous and considerably reduce their functionality, especially where they do not have appropriate resource support, and any resuscitation needs to be carried out in less than optimal conditions, while awaiting for transfer to more appropriately resourced centres. Personality clashes are also exacerbated in these conditions

and it is clear there was an issue between Dr Mbaogu and at least two of the nurses in this case.[61]

I note Dr Mbaogu provided his summary of care of the deceased in the days following her death at which time her cause of death had not been established.

Her cause of death was determined on 14 May 2012 and even then was not definitive.

The difficulty is magnified in the case of the deceased where we have a young, apparently healthy, woman at the beginning of a productive and full life, exhibiting symptoms, which have a likely diagnosis in that environment, but which turned out to be misleading, without the availability for real time diagnostic aids. Young people tend to compensate deteriorating function until the situation is extreme. Once that point has been reached it may be too late for intervention.

This is the difficulty of the provision of medical care in remote and rural settings.

[61] T.24.2.15, p90, 91

Recommendations

Dr McComish, taking into account the difficulties for remote clinicians, believed consideration should be given to a lowering of the threshold for the ordering of blood cultures in cases of acute febrile illnesses. This would also support the earlier administration of broad spectrum antibiotics following taking bloods for culture.[62]

Dr Montgomery was more resistant to a lowering of the threshold for the administration of broad spectrum antibiotics due to the efforts of microbiologists to promote appropriate use of antibiotics to limit bacterial resistance to currently effective antibiotics.[63]

Dr Montgomery was of the view that if a clinician believed, on clinical grounds, there was the likelihood of a bacterial infection then it would be appropriate to administer broad spectrum antibiotics after bloods had been taken for diagnostic purposes. Dr Montgomery was also of the opinion antibiotics would not usually be used for gastroenteritis whether viral or bacterial, depending on the clinical presentation.

In this case Dr Mbaogu did not believe the basis of the deceased's illness was bacterial. He believed it was viral,

[62] T.24.2.15, p41
[63] Additional information provided by WACHS on 13 March 2015 and provided to all parties

and did order diagnostic tests for viral infections on 14 March 2012 as a precaution.

Dr McComish agreed the deceased's presentation (barring the temperature spike at 3pm on 14 March 2012, not known to Dr Mbaogu) was not solely attributable to a bacterial infection, rather that *"something else was going on there"*[64] following apparently successful hydration.

Accepting all of the above, and the fact any results would be too delayed to be helpful in the event of a *"crash"*; then I would have thought there was a good argument to indicate broad spectrum antibiotics, where there was a concern by a clinician there may be reason for any form of additional diagnostic tests, were also a useful option to consider. I am not suggesting the indiscriminate use of antibiotics, but the lowering of the threshold for the administration of broad spectrum antibiotics in certain cases, taking into account the difficulties of resuscitating patients in the remote setting. We still do not know that the administration of broad spectrum antibiotics would have saved the deceased's life, only improved her chances.

I understand the concerns surrounding the indiscriminate use of antibiotics but am aware there are exceptions where it has been considered the high threshold currently

[64] T.24.2.15, p40

supported may be too high in certain circumstances in the remote setting.[65]

Certainly, Dr Mbaogu agreed his clinical judgement threshold is no longer as high as it was in March 2012, in a remote setting, for administration of broad spectrum antibiotics.

Consequently, I am still of the view a recommendation supporting the consideration of broad spectrum antibiotics at an earlier point, as part of the clinical judgement taking into account the lack of facilities available in the remote setting for intensive resuscitation, is warranted.

Accordingly;-

Recommendation No.1

I recommend clinicians in remote settings consider their capacity to resuscitate patients with sepsis, when assessing a patient's clinical presentation and the threshold for the administration of broad spectrum antibiotics, following the taking of bloods for diagnostic purposes.

Recommendation No.2

I recommend additional education and audits on use of the AORC in Paraburdoo to ensure appropriate use of those charts.

[65] *Febrile Child 5 years and Under Policy* introduced into the Kimberley in November 2011

Recommendation No.3

I recommend user friendly flow charts summarising the guidelines and procedures in operation in rural and remote health services for the successful collection of bloods be placed in collection areas where they are not already in existence.

E F VICKER
DEPUTY STATE CORONER
25 May 2015